NATIONAL INSTITUTE OF SCIENCES OF INDIA.

Symposium on Vegetable Oils and their Products.

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Symposium on veg.

NATIONAL INSTITUTE OF SCIENCES OF INDIA

SYMPOSIUM
ON
VEGETABLE OILS
AND
THEIR PRODUCTS

NEW DELHI

OCTOBER,
17TH & 18TH
1958

CENTRAL FOOD TECHNOLOGICAL RESEARCH
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PREFATORY NOTE

The Council of the National Institute of Sciences of India at their meeting held in October, 1957, at New Delhi and in March, 1958, at Calcutta, decided to organize a symposium on "Vegetable Oils and Their Products." Dr. U. P. Basu was appointed convener to organise it. Subsequently steps were taken to secure the co-operation of experts, persons and institutions, and different Ministries interested in the subject. Circulars were issued indicating the scope of the symposium. The response was very encouraging and the National Institute of Sciences of India wishes to express their thanks to the contributors of papers and to the institutions for the great interest shown.

India is completing the 3rd year of her Second Five-Year Plan. There are impediments to the succesful implementation of the Plan. But the country will look to the scientists and technologists for solution of many of her problems. In vegetable oils and their products new potentialities may be found to step up exports and to reduce imports. The nature of papers received indicates that there are untapped resources for exploitation, and it is for the policy-makers and the industrialists to take advantage of the same.

In the present brochure abstracts of 56 papers are being published and the following noting shows the names of the institutions that have co-operated in the venture of the National Institute of Sciences of India.

A. State Organizations

1. Directorate of Economics and Statistics, Ministry of Food & Agriculture, New Delhi.
2. Naval Chemical and Metallurgical Laboratory, Ministry of Defence, Bombay.
3. Botanical Survey of India, Ministry of Scientific Research, Calcutta and Poona.
4. Khadi and Village Industries Commission, Ministry of Agriculture, Hyderabad—Dn.
5. Development Wing, Ministry of Commerce & Industry, New Delhi.

B. National Laboratories.

1. National Chemical Laboratory, Poona.
2. Central Food & Technological Research Institute, Mysore.
3. Regional Research Laboratory, Hyderabad—Dn.
4. Central Drug Research Institute, Lucknow.

C. Universities & College.

1. Department of Chemical Technology, University of Bombay.
2. University College of Science & Technology, Calcutta.
3. University of Nagpur, Nagpur.
4. Lakshminarayan Technological Institute, Nagpur.
5. Fergusson College, Poona.

D. Research Institutions.

1. Bengal Immunity Research Institute, Calcutta.
2. Indian Association for the Cultivation of Science, Calcutta.
3. Indian Standards Institution, New Delhi.
4. H. B. Technological Institute, Kanpur.

E. Industrial Organisations.

1. Kusum Products Limited, Calcutta.
2. Mysore Government Soap Factory, Bangalore.
3. Snow White Food Products, Howrah.
4. Tata Oil Mills, Bombay.

The Symposium will be held at the National Institute of Sciences of India, Mathura Road, New Delhi, on Friday 17*th October from* 3.15 *p.m. to* 5 *p.m. and will continue on Saturday,* 18*th October,* 1958, *from* 10 *a.m. to* 1 *p.m. and from* 3 *p.m. to* 5 *p.m.*

Note : It is requested that papers and summaries of remarks and observations during the discussions should be handed over to the Convener immediately after the meeting or as soon as possible thereafter.

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INTRODUCTORY REMARKS

VEGETABLE OILS AND THEIR PRODUCTS

Oil seeds are important commercial crops of India, and are cultivated as "Kharif" (autumn) and "Rabi" (winter) crops. They are largely used for fat in the diet of the people, provide raw materials for certain oil-based industries, and are a good foreign exchange earner. There has been in recent years a sizable increase in the consumption, and at the end (1960-61) of the Second Five-year Plan the production is expected to come at 7,600,000 tons per year. This stepping-up of production is more necessary in order to keep pace with our growing population as well as with industrial development. Crop production may fluctuate, but the increase in population continues to be relentless.

A critical study on the yield of oilseeds per acre, output of oils, and their export figures in different countries would tend to indicate that much improvement in cultivation, better method of extraction of oil, and more commercial use of meals would be essential in order to augment the economy of these cash-cum-food crops of India. It may be noted that while the consumption of edible oils in any country, is determined by the level of per capita income, the consumption of non-edible oils, on the other hand, is linked with conditions of industrial activity of the country. According to the report of the Food and Agricultural Organisation the *per capita* consumption of all fats and oils was 11.4 kg in 1955-56 in the world excluding U.S.S.R. The same in North America was about 29.4 kg., whereas the figure comes down to 4.7 kg. in Asia (excluding China).

Vegetable oils and their derivatives are raw materials for various industries. They support a big urban population and offer employment to a still bigger volume of rural population in cottage and small scale industries. The potentialities of oil bearing seeds and fruits are immense. Vegetable oils

and their products account for nearly 5 per cent of India's total exports. During 1955-56 their exports were of the value of Rs. 34 crores, in 1956-57 Rs. 26.8 crores, and in 1957-58 only Rs. 16 crores. In order to expand the export trade, a study of the World market conditions, rationalisation of domestic consumption, and production at high level would be necessary. As such, by continuous investigations on their different and newer uses as well as by discovering newer sources of vegetable oils, the whole economy of these vegetable crops is to be improved.

Perhaps many thought-provoking and interesting suggestions would be forthcoming from the scientists, technologists, and experts who have assembled here for the discussion. It may, however, be concluded by noting that the symposium will be a real success if a lead might be given in grading of vegetable oils for their different uses on the basis of their availability and their actual composition.

U. P. BASU
Convener

SECTION A

GENERAL SURVEY ON VEGETABLE OILS

1. **The importance of Oilseeds, Vegetable Oils and Oil Cakes in the Economy of India—A Survey** *by* R. N. PODUVAL, *Directorate of Economics and Statistics, Ministry of Food and Agriculture*, New Delhi.

Oilseeds, vegetable oils and oilcakes occupy a very important place in the agricultural, industrial and commercial sectors of the Indian economy. Oilseeds serve as the basic raw material for oil-milling industry and thereby provide employment for a large number of people in the urban and rural areas. Vegetable oils constitute the main source of fat supply in the dietary of the people ; in addition, they serve as

important raw material for industries like vanaspati, soap, paints and varnishes. Oilcakes provide the much needed nutrition for the cattle and serve as manure for the soil. In the foreign trade of this country also, oilseeds and their products play quite a significant part. Data regarding the statewise distribution and production of various oilseeds and oil milling industry, are presented including their year to year expansion Various measures for increased production of oilseeds for higher internal consumption of their products as well as present export policy, have been discussed.

2. **Some aspects of the less and little known oil-yielding plants of India** *by* K. S. SRINIVASAN, *Indian Museum*, Calcutta.

It is hardly 50 p. c. of the Families (Natural orders) of Phanerograms represented in India, that are now known for their species yieiding oil. Systematic survey of the oil-yielding plant resources of our forests, including the unexplored and under-explored areas, is therefore, imminent. The chemical and physical properties of many of our vegetable oils, as also the economic information on them, are not fully known and intensive work on such lines is highly desirable. Introduction of foreign species, which might be beneficial to our country, is strongly recommended ; *e.g. Pectis papposa* Gray, native of Mexico, is found to be rich in cumaldehyde and carvone, and as such considered as a potential commercial source of these fragrant aldehydes. The examples of several foreign countries, during critical periods, or emergent international situations, as that of World War II, in launching on their own new enterprises in respect of vegetable-oil production on commercial scales, by intensive exploitations, by exploring new area for possible resources, by introducing known economic species of importance and extensive cultivation, etc., are commended to keep in tune with the activities of the most enterprising countries, to raise the economic standards of the country. An Economic Herbarium, specially devoted to the oil-yielding plants of Indian Union, is strongly recommended to be developed at the Industrial Section, Indian Museum, Botanical Survey of India. Calcutta. A systematic list of the

known oil-yielding plants in India, wild, cultivated or introduced, is given at the end of the paper.

3. **Minor Oils of Forest Origin** *by* M. V. SUBBA RAO, *Khadi and Village Industries Commission*, Hyderabad Deccan.

There are various lesser known vegetable oils of forest origin, mostly non-edible, about which suitable data needed for their utilisation are lacking. The author draws attention to the urgent need of initiating research in this line and discusses some of the factors involved in their processing and application for the various industries.

4. **Lesser Known Oil Seeds** *by* T. S. RAMASWAMY, *Research Laboratory, Tata Oil Mills Co. Ltd., Sewri*, Bombay–15.

Importance of augmenting our oil resources by developing the supply of the lesser known oils is discussed.

5. **Abundance of Untapped Raw materials for production of Vegetable oils—Rice Bran and Cotton Seed** *by* Y. K. RAGHUNATHA RAO and K. G. KRISHNAMURTHY, *Central Food Technological Research Institute, Mysore.*

RICE BRAN : Indian production of Rice Bran is estimated at about 2 million tons. It is produced at rice mills and in handpounding, all over the country. Collection of the bran is easy and quick at the rice mills. Bran collected from the numerous village centres, may be days or weeks old. Bran contains 10 or 30 per cent oil, while fresh bran yields high-acid oil suitable for soap making and for production of fatty acids. By-products of the extraction process are industrial rice wax, edible sugars and extracted bran, which is a cattle feed. The estimated recovery of rice oil is 3,00.000 tons per annum valued at 30 crores of rupees.

COTTON SEED : Estimated production of cottonseed is 1.5 million tons. It contains 15-18 per cent oil. Estimated possible production of oil is 2,00,000 tons per annum. High yield of edible oil is possible only by solvent extraction, with alcohol along with the by-product—edible cottonseed flour or

meal. The latter is suitable for both human and animal feed, being free from gossypol but rich in protein. Stored and decayed cottonseed yields low grade industrial oil.

6. **Progress in Research on Indian Minor Vegetable Oils** *by* T. V. SUBBA RAO, *Research Laboratory, Tata Oil Mills Co. Ltd., Sewri,* Bombay–15.

A review of work done on the Indian minor Vegetable Oils and Fats is presented to focus the attention on the economic-cum-technological problems that need attention to promote the better utilisation of the minor oilseeds and oils and to increase the minor oilseed wealth of the country.

7. **Development of Soap Industry in India : Its problems and their probable solutions** *by* K. S. KRISHNAN, *Kusum Products Limited,* Calcutta.

The over-all installed capacity of the soap industry is estimated to be 3,58,000 tons while production is expected to increase upto 3,00,000 tons by 1960-61 so that there is no need to add any new capacity to industry although some of its idle capacity has to be transferred to the organised factories to effect its full utilisation.

Further, the set-up of the soap industry in India is rather peculiar as it consists of a Cottage Sector and an Organised Sector, with divisions within each sector. Since these different groups face different problems they need closer scrutiny for their rational solution, for which specific measures are suggested.

To achieve a production of 3,00,000 tons of soap it is necessary to ensure adequate supply of requisite raw materials like oils, caustic soda and perfumes.

The Soap Industry is already facing shortage of oils which has to be solved by popularising the use of non-edible oils for which their technological problems need solution. Refining and hydrogenation capacity has to be increased to produce hard oils for soap making. Coconut Oil has to be conserved by manufacturing soaps by the technique of vacuum cooling and plodding.

The supply of raw materials is to be further augmented by producing cheap and good quality fatty acids for which the fat-splitting and fatty-acid-distillation industry has to be promoted. This industry offers manifold advantages to the soap and glycerin industry that need consideration.

The present acute shortage of foreign exchange demands self-sufficiency in the supply of requisite machinery. Thus a sound scheme is required to organise necessary facilities for designing and fabricating modern plants within the country.

All these aspects of the problems have been discussed in the paper.

8. **Cottonseed Oil Industry in India** *by* N. BHOWMICK, *Development Wing, Ministry of Commerce and Industry.* New Delhi.

The Cottonseed Industry in India is in its infancy. Out of annual production of cottonseeds (1.65 million tons), only 8 to 8·5% is at present utilized for crushing. Rest is used as cattle fodder. A proper development of industry would add to the Nation's wealth about Rs. 20 crores annually. A brief history of development of this industry and the various impediments standing in its development have been incorporated in the present discussion. The plan target at the end of 1961, the regional distribution of this industry, the various types of cottonseeds, their relative merits and demerits have also been discussed. The peculiar difficulties in refining of cottonseed oil, the attendant handicaps in its manifold industrial uses, consumption of this oil, its export, the problem of its utilization and the rational solution to these difficulties have also been indicated. Importance of two subsidiary industries, i. e.. cotton linters and its possible utilization in various chemical industries, the cottonseed hulls and meals as important fodder and cottonseed cakes as manure has also been indicated. Manufacture of fatty acids from this oil and its soap stock for the production of soap, textile auxiliaries, rubber chemicals, etc. have been specially pointed out.

9. On Newer and Better uses of Non-edible Oils *by* P. V. SHRIKANTA RAO, *Khadi and V. I. Commission*, Bombay.

The importance of any oil lies in its properties. The recent developments in the oil technology have offered considerable opportunities to exploit even the non-edible oil seeds which hitherto had remained untapped.

The Non-edible oils because of their bad colour and odour were used so far mainly for lighting, lubrication, varnish making and for tanning purposes. The advance in the research of oil technology has widened the scope for the utilisation of these non-edible oils in pharmaceuticals and other consumer industry. Use of glycerin, stearic acid and oleic acid are becoming popular and the important source of these are the vegetable oils. These could be found in a good measure in a number of Ne-oils, It is, therefore, very necessary that a concerted effort be made to harness and chanalise the use of the non-edible oils which are so bountiful in our country. By doing so, there is an additional advantage in that these non-edible oils could replace an equal quantity of edible oils from industrial field and make available the same for human consumption.

Soap making is one of the consumer industries where large quantities of non-edible oils can find their way. Though in some of the well developed countries "Syndets" have replaced saponified soaps, still in a country like ours the place of saponified soaps would definitely be maintained in its present position for a number of years to come.

The names of the non-edible oils like Pisa and Khakan, well known for their high lauric acid content, deserve special attention here.

Whether it be for the purposes of export or be for increasing the internal consumption of edible fat, or for various industrial uses, the exploitation of non-edible oil seed wealth of our country to the maximum is a need of the day.

Steps should be taken to develop the field technology regarding these non-edible oil seeds resources so as to offer

suitable technical guidance to the people to determine the proper maturation period, improved methods of collection and storage. It will also be pertinent to create conditions enabling these oilseeds to secure a social and commercial status like their edible counter-part. In this regard, it is advisable that different agencies like the Indian Central Oilseeds Committee, Khadi & Village Industries Commission and others draw out a properly co-ordinated plan of their activities so as to achieve the desired results.

10. Survey of some important oil yielding plants of Western India *by* G. S. PURI and S. K. JAIN, *Botanical Survey of India*, Poona.

The authors have been engaged in an intensive and extensive botanical exploration of the Western India. Special attention has been given to the economic plants. Notes on distribution and survey of oil yielding plants of Western India have been prepared and published from time to time in the regional floras under preparation. The floras of Deccan Trap, North Kanada, Mahabaleshwar, western Rajasthan and Kutch have described the oil-yielding plants of these areas. Abundant wild growth of *Cymbopogon martini* (Rosha grass) in western India attracted the attention of the authors and they brought this fact to the knowledge of government and also public.

The present paper briefly described 21 oil-yielding plants of western India. Their detailed distribution derived from the original collection of the authors and their colleagues and the material lodged in the Poona herbarium has been given. The knowledge of exact localities of occurrence of these oil-yielding plants will enable their proper exploitation. The survey work is in progress and more detailed information will be available in due course.

The following oil-yielding plants are described in the paper with full notes on their distribution and occurrence in western India—

Balanites aegyrtiaca Del. (Simarubaceae), *Boswellia serrata* Roxb. (Burseraceae), *Calophyllum inophyllum* Linn.

(Guttiferae), *Cinnamomum zeylanicum* Blume. (Lauraceae). *Cymbopogon martini* Stapf, (Gramineae), *Cyperus rotundus* Linn. (Cyperaceae), *Emblica officinalis* Gaertn. (Euphorbiaceae), *Garcinia indica* Chois. (Guttiferae) *Madhuca indica* Gmel. (Sapotaceae), *Mallotus philippensis* Muell. (Euphorbiaceæ) *Mesua ferrea* L. (Guttiferæ) *Michelia champaca* Linn. (Magnoliaceae), *Mimusops elengi* Linn. (Sapotaceae), *Mamia longtfolia* Planch and Triana. (Guttiferae), *Pongamia pinnata* Pierre. (Papilionaceae), *Salmalia malabarica* Schott and Endl. (Malvaceae), *Schleichera oleosa* Oken. (Sapindaceae), *Semecarpus anacardium* Linn. (Anacardiaceae), *Serminalia bellerica* Roxb. (Combretaceae), *Vateria indica* Linn. (Dipterocarpaceae), *Vetiveria zizanioides* Stapf. (Gramineae).

SECTION B

APPLICATION OF EDIBLE AS WELL AS NON-EDIBLE OILS

1. Vegetable Drying Oils—Their Role in Naval Protective Coatings *by* B. SREENIVAS RAO *and* V. V. KELKAR, *Naval Chemical and Metallurgical Laboratory*. Bombay.

The role of drying oils in the field of coatings has been discussed with special reference to Naval protective coatings. The impact of modern developments on the synthetic resin field on the utilisation of drying oils in protective coatings has been indicated. In this country, producing a large tonnage of drying oils, it is natural that protective coating formulations should incorporate drying oils in a large measure. Anticorrosive paints for protection of ships' hulls against submerged corrosion; antifouling paints, which prevent settlement of biological fouling organisms on submerged hulls ; and weather-work primers and finishing paints, which protect superstructures of ships from marine atmospheric corrosion, are the most important classes of Naval protectives. The problems associated with the incorporation of drying oils

in the formulation of these coatings are discussed in detail against the background of the marine corrosion and fouling. The facilities available for testing and the research and development projects undertaken by the Naval Chemical and Metallurgical Laboratory, Bombay, in the field of Naval protective coating are briefly indicated.

2. **Utilization of Cotton Seed Oil in Vanaspati Manufacture** *by* P. N. MATHUR, *Snow White Food Product Co. Ltd.*, Howrah.

Cotton seed has been recognised as a valuable source of edible oil all over the world. India produces 1.7 million tons of cotton seed annually but less than 6p.c. is crushed for oil. Recently Govt of India have shown an active interest for encouraging cotton seed crushing Industry.

In this paper the processing of washed cotton seed oil which can be used for the manufacture of Vanaspati without affecting quality of the finished product is discussed. The paper also deals how refining losses can be minimised, and economic bleaching can be effected. The complete process of the manufacture of Vanaspati from cotton seed oil is discussed in detail.

Production of Vanaspati is expected to go upto 400,000 tons by the end of second plan and it is essential that 60,000 tons of cotton seed oil can be produced by 1960–61. The entire quantity of cotton seed oil can be consumed in Vanaspati Industry for the manufacture of Vanaspati as well as hardened oil for industrial purposes provided oil of good bleachable quality is available.

3. **Surface Active Properties of Sulphated Esters of Castor Oil Fatty Acids** *by* S. S. BELLIHAL *and* J. G. KANE *Department of Chemical Technology, University of Bombay*, Bombay.

Sulphation of methyl, ethyl and butyl esters of castor oil fatty acids has been studied with a view to obtain products

better than Turkey red oil. The sulphated esters were found to be incompletely miscible with water inspite of their appreciable contents of organically combined SO_3. When extracted with petroleum ether, the products gave raffinates which were found to be far superior to Turkey red oil in wettability, foaming, and stability to acids, alkalis and calcium salts.

4. **Fatty Acids and Synthetic Perfumery Materials** *by* U. G. NAYAK *National Chemical Laboratory*, POONA.

Fatty acids play a key role in the synthetic perfumery industry. India with her vast resources of oil seeds occupies a pre-eminent position in this respect.

In the National Laboratory, based on constituents derived from indigeneous oils, methods have been established for the synthesis of dihydrojasmone, undecalactone, dihydro-iso-jasmone heptaldehyde etc., Several 1-w dicarboxylic acids and 1-w ketodicarboxylic acids obtained from shellac, kamlolenic acid, oleic acid, mustard oil have lead to the successful synthesis of Civetone, Dihydrocivetone, Evaltone, Exaltolide etc. Nonoic aldehyde which is widely used in perfumery industry is obtained as a valuable by-product during these syntheses.

5. **Utilisation of Oilseed Meals for the Preparation of Fortified Protein Food** *by* V. SUBRAHMANYAN, R. RAJAGOPALAN *and* M. SWAMINATHAN, *Central Food Technological Research Institute*, Mysore.

In view of the acute shortage of supplementary foods, such as milk, fish, meat etc, it was thought that the abundant resources of the country in oilseed meals could be processed into highly nutritious supplementary foods suitable for human consumption. After a careful investigation it was found that groundnut meal would form the best source. This protein-rich meal, though somewhat poor in quality was mixed with a pulse protein (Bengalgram dhal) to yield a protein of high quality.

Processing conditions for obtaining a low-fat groundnut meal suitable for human consumption have been standardised. The final food has been fortified with vitamins (A D, B_1 & B_2) and minerals (Calcium phosphate) so as to make the food a well balanced supplementary food. Two ounces of the food supplies one-third of the daily requirements of protein, vitamins and minerals.

Extensive studies designed to bring out the nutritive value of the food have been carried out. Experiments on the supplementary value of the food to poor cereal diets have given highly satisfactory data. The food when given at 2 oz. level to young school children has been found to be well digested with a resulting increased weight and better nutritional status.

The results so far obtained from field trials are highly favourable. It is thus possible to overcome and cure protein malnutrition in the vulnerable groups of population.

The method of processing and the details of the different experiments conducted and the observations made will be discussed.

6. Preparation and Utilisation of Dehydrated Castor Oil (DCO)
by M. A. SIVASAMBAN, S. NEELKANT RAO, N. BHOJRAJ NAIDU *and* S. A. Saletore. *Regional Research Laboratory*, Hyderabad – Deccan.

The main types of catalysts for the dehydration of castor oil are summarised. The use of sodium bisulphate for the preparation of dehydrated castor oil leads to the dark colour of the oil. Quite a pale coloured oil is obtained if a small quantity of sodium bisulphite is added along with sodium bisulphate when the castor oil attains the temperature of 180-200°C and dehydration is carried out in the atmosphere of carbon dioxide or under high vacuum at 220-240°C. The darkening of the oil after the dehydration and after tack of its film are much reduced if about 2 per cent slaked lime is added to the product when it is cooling, A preliminary refining of raw castor oil also improves the quality of the

dehydrated product. Monomeric dehydrated castor oil which is almost completely free from after tack is made if a small amount of zinc dust or sodium sulphite is added along with sodium bisulphate and sodium bisulphite during the dehydration of castor oil.

The monomeric dehydrated castor oil has been found especially suited for the preparation of co-polymerised alkyds. These alkyds are light coloured and give substantively non-tacky films on air drying and hard and glossy films on stoving.

Varnishes based on D. C. O. are superior in drying time and alkali resistance to those based on linseed oil, the monomeric D. C. O. varnishes especially show remarkable alkali resistance on ageing.

Based on pilot plant experiments the costs of monomeric and bodied D. C. O. have been calculated and found to be only 0.17 and 0.34 rupees per pound more than the price of refined castor oil.

7. **Recent Developments in the modification of Vegetable Oils for Surface coating Industry**, *by* OM PRAKASH, A. C. GUPTA, S. S. CHOPRA. *Oil Research Laboratory, H. B. Technological Institute,* Kanpur.

A general reveiw of developments in the field of modification of drying oils to meet the everincreasing demands of the protective coating industry is given, tracing past achievments, present developments and future trends. Importance of utilizing linseed oil and castor oil for the growing paint industry in the country is stressed. Various methods for isomerisation of linseed oil are indicated; work carried out at H. B. T. I. Kanpur, shows that linseed oil can be best isomerised by using anthraquinone (5%) as catalyst, at 250°C for 30 minutes giving maleic anhydride value of 15.5 and 1% of iodine at 200°C and time of reaction 1½ hours has been found to produce conjugation corresponding to maleic anhydride value of 23. Various catalysts suggested for manufacture of D. C. O. are mentioned. Work done at H. B. T. I., Kanpur, shows that,

1% of fused sodium bisulphate for 90 mts. at 250°C in inert atmosphere gives a product of low acid value and pale colour. Recent trends like segregation, inter-esterification and co-polymerisation with styrene point to the direction of future development.

SECTION C

SCOPE FOR NEWER AND BETTER UTILISATION OF NON-EDIBLE OILS.

1. **Investigation of less-known oils in hydrogenation industries : Use of Tobacco Seed Oil,** *by* M. K. CHAKRABARTY and M. M. CHAKRABARTY, *Department of Applied Chemistry, University College of Science & Technology*, Calcutta.

For sometime past newer source materials are being sought for replacing older and conventional source materials in the hydrogenation industries. In the present work, tobacco seed oil has been investigated as to its suitability for hydrogenation for being used in edible and other industries. It has been estimated that a large quantity of tobacco seed oil can be available as a by-product by suitable modification of harvesting procedures and according to an official estimate, about 3000 tons of oils were available for marketing in 1956-57. In the present work, investigation has been undertaken to find out the refining and hydrogenation characteristics of tobacco seed oil. Technical details such as nature and quantity of refining agents required, percentage loss in refining have been established. Further, the variation of the characteristics and chemical composition of the hydrogenated product, and condition of hydrogenation have been investigated. Points as to selectivity, iso-acid formation, catalyst concentration have been recorded

2. **Some studies on the Utilisation of Karala Seed Oil in the Surface Coating Industry,** *by* S. SEN *and* M. M. CHAKRABORTY,

Department of Applied Chemistry, University College of Technology, Calcutta.

A search for substitute for Tung oil has become very important, specially after independence, as it involves foreign exchange, which should be conserved.

Karala seed oil contains more than 50% triene conjugated acid similar to that present in Tung oil and the agricultural information indicates that the oil can be had in plenty if cultivated.

In the present work investigation has been undertaken to find out the effect of heat on the oil, effect of driers, properties of varnish and alkyd prepared with the Karala seed oil and a comparative study of the same with that of Tung oil and D. C. O.

3. Processing and utilisation of nim and other non-edible oils, *by* CHITTARANJAN MITRA. *National Chemical Laboratory*, Poona.

Conventional methods of refining vegetable oils are of little avail in the case of non-edible oils such as of nim (*Melia indica*), karanja (*Pongamia glabra*) undi (*Calophyllum inophyllum*), etc. As a result, their utilization in soap and allied industries is limited. With a view to find proper industrial utilization of these resources, systematic investigations on the non-edible oils have been carried out, and some of the results of this investigation having important bearing on the non-edible oils industry, are briefly discussed in this paper.

It has been found that these fats freed of the non-glyceridic constituents can be processed economically for their uses in soap, stearin and other industries and even perhaps for edible purposes. The physiologically active non-glyceridic constituents of some of these oils such as nim, have shown certain specific medicinal properties. This ensures fuller use of these oils and will also reduce the cost of their processing. The processes for the industrial utilization of these fats are being worked out on pilot plant scale.

4. **Surface-Active Properties of Mono-ghyceride sulfates obtained from Non-edible Oils** *by* B. K. MUKHERJI *and* ARUN BISWAS, *University College of Science and Technology*, Calcutta.

Attempts have been made to prepare useful surfactants of the monoglyceride sulfate type from four inedible oils, available in India—Neem, Polang, Karanjia, Nahor. Physico-chemical constants of the oils, their fatty acid composition, the results of glycerolysis and subsequent sulfation of the glycerolysis products have been reported. Monoglyceride sulfates, as such, have been found to possess poor tensioactive properties ; corresponding sodium salts are, however, found to be superior surfactants. Considered from the results of the evaluatory tests e. g, surface tension determination, sinking time test, calcium stability etc. Neem surfactant is adjusted to be the best one. Superior foaming characteristic of Polang surfactant is perhaps due to large amount of soap present in it which, on the other hand, is responsible for poor calcium stability. In equal concentrations, Neem surfactant is quite comparable in its properties to marketted surfactant like Turkey Red oil. Superiority of Neem product might be attributed to the presence of low molecular weight fatty acids present in the oil,

SECTION D

IMPROVEMENT IN PRODUCTION METHODS.

1. **Refining of Vegetable oils with urea** *by* T. N. MEHTA *and* M. S. MURTY. *Laxminarayan Institute of Technology*, Nagpur.

The refining of different vegetable oils of high acidity by means of urea using water as a catalyst has been studied, Urea used amounts to ten times the weight of free acids and the ratio of water to urea is 1 : 2. Coconut, palm and rice bran oils of 6%, 21% and 31% F. F. A. have been de-acifified to 1%, 3.9% and 11% F. F. A. content respectively.

2. **Refining of Waxes by Fractionation with Urea** *by* T. N. MEHTA *and* B. N. MURTHY. *Laxminarayan Institute of Technology*, Nagpur.

Beeswax, carnauba wax and sugarcane wax were refined by extractive crystallization with urea, when pure straight chain compounds were obtained. The waxes were considerably reduced in colour by this method.

The different fractions were analysed for their iodine, saponification, and acid values from which the properties of each fraction were determined.

Sugarcane wax refined by urea has a low acid value as compared to that refined by oxidation methods, and can be used directly as a valuable substitute for carnauba wax.

3. **Preparation and Properties of Activated Urea** *by* T. N. MEHTA *and* M. S. MURTY, *Laxminarayan Institute of Technology*, Nagpur.

Urea adduct of lauric acid was extracted with benzene in a Butt extractor for about 8 hours. The solid urea obtained was found to be more reactive than ordinary urea in its adduct forming tendencies. Hence it was given the name activated urea Activated urea formed adducts with the fatty acids without the addition of any catalyst such as water or methanol.

4. **An Easy Method of Separation of the Major Fatty Acids of Karla Seed Oil** *by* V. A. SARAF *and* K. K. DOLE, *Fergusson College*, Poona.

The oil obtained from Momordica Charanthia, Linn (Karela) contains in its component acids about 46. 7 per cent. of α-eleostearic acid, 29. 8 per cent. of stearic acid ; the rest is comprised of oleic acid and linoleic acid. The percentage of stearic acid being appreciable, the separation of the total fatty acids into the saturated and unsaturated constituents by employing solvents like alcohol and acetone is carried out.

It is observed that most of the stearic acid (the main saturated constituent of the mixed fatty acids) can be crystallised out, thus enriching the unsaturated part in the soluble fraction.

The enriched unsaturated fraction can be successfully employed for the preparation of alkyds either alone or blended with linseed oil fatty acids.

5. Application of Ethyl Alcohol—The Indigenous Non-Petroleum Solvent in the Extraction of Vegetable oils *by* Y. K. RAGHUNATH RAO, *Central Food Technological Research Institute,* Mysore.

A *commercial process* has been developed for the solvent extraction of vegetable oils, by the indigenous solvent, ethyl alcohol at or above its boiling point. Industrial alcohol is abundant production from molasses, by-product of the *Indian Sugar Industry*. It is cheap, costing less than a rupee a gallon, while imported petroleum solvents cost thrice as much. Alcohol is also the better solvent by reason of its edibility and non-toxicity. It is an economic solvent by virtue of its elevated and constant boiling point, low vapour pressure and consequent lower process—loss. It is a safer solvent on account of its lower inflammability and miscibility with water. Both industrial and absolute alcohol have been found suitable for extraction of all vegetable oils—especially cottonseed oil, rice bran oil and wheat bran oil,

A Flow Diagram is described and enclosed.

6. Hydrogenation of Linolenic Acid by Hydrazine Hydrate *by* C. V. N. RAO, *Laxminarayan Institute of Technology,* Nagpur.

Hydrogenation of linolenic acid by hydrazine hydrate at 50°C using a mole ratio of 5 : 1 of hydrazine hydrate to acid has been studied. Samples were taken out at intervals over an eight hour period and their iodine values were determined. The iodine values obtained indicate that the linolenic acid too can be hydrogenated with hydrazine bydrate.

Infra-red spectroscopy of the samples obtained was studied at 10μ region and the evidence suggested that no appreciable amounts of *trans* acids are formed during hydrogenation by hydrazine hydrate.

7. Fat splitting and fatty acid distillation industry *by* T. S. RAMASWAMY *and* N. DESIKACHAR, *Research Laboratory Tata Oil Mills Co. Ltd., Sewri,* Bombay.

The economical utilization of fatty materials like dark coloured oils, low grade oils and fats like grease etc. and cotton seed oil foots has been made possible by the process of fat splitting and fatty acid distillation. The scope of the industry in India is discussed in this paper.

8. Solvent Extraction Process in the Secoond Five Year Plan *by* N. G. CATTERI, Calcutta.

The present difficult foreign exchange position has practically stopped the import of the more efficient continuous solvent extraction plants and it is being advocated to go in for the batch or semi-continuous plants which can be fabricated in this country. It is doubtful if such plants of comparatively large capacities would be able to hold their ground once the situation improves and continuous plants are installed.

The economic advantages of continuous plants increase with capacity and hence batch or semi-continuous plants would be quite all right if they are used for the processing of "non-edible minor seeds" which are available in comparatively small quantities only.

An offshoot of the solvent extraction process is the "miscella refining of oils", in which the refining of oils gives almost the theoretical value for 'refining factor', even with oils containing a high percentage of free fatty acids, such as mohwa and rice bran oils. This method of refining mohwa cil deserves serious consideration by oil hardening factories as it offers interesting industrial possibilities.

In the recently announced scheme of investigation on on the extraction of rice bran oil, undue emphasis has been

laid on the process of extraction with solvents which presents practically no problem at all. On the contrary unless the crude oil can be refined economically to produce neutral oil for edible purpose, it would be prudent not to build any high hopes on the successful marketing of rice bran oil.

9. Oil soluble nonfatty matter and nonfatty acids in crude oils and their influence on oil processing *by* V. G. RAO, Ernakulam.

The refining loss encountered in vegetable oil refining considerably affects the economy of processing. Various factors which are responsible for increasing the refining loss have been discussed. Apart from free fatty acids, the oil contains both nonfatty acids and acids derived from hydrolysis of nonfatty matter, the presence of which can give rise to serious losses at the refining stage and may also cause difficulties such as frothing in refining and during hydrogenation,

The usual methods of analysis of fats and oils and of reporting analytical data should also be modified in the light of nonfatty matter and nonfatty free acids present in the oil.

The paper also discusses methods for the removal of nonfatty matter from the oil by alkali refining.

10. The separation of fatty acids using urea *by* K. T. ACHAYA *and* S. HUSAIN ZAHEER, *Regional Research Laboratory*, Hyderabad.

The increasing use of specific individual fatty acids for definite purposes, e. g. of linoleic acid by mouth for the prevention of atherosclerosis and eventual heart disease, has led to an interest in commercial methods of separation. These methods include solvent crystallisation and fractional vacuum distillation, neither of which, as now industrially applied, separates unsaturated acids among themselves. The utility of urea adduction for this purpose is illustrated by data on the complete resolutions of natural fatty acid mixtures, and the variations of procedure possible. In all cases, the mixtures

can be separated into simpler fractions each containing predominantly one fatty acid. An interesting application of the urea technique is the almost quantitative recovery from dark cottonseed oil-refining foots of light-coloured fatty acids in two crops of low and high unsaturation. Considerations bearing on large-scale application are discussed.

11. Utilization of spent nickel catalyst from Vanaspati industry-Recovery of fat, filteraids and nickel and its reactivation
by OM PRAKASH, ATMA RAM *and* JAGDISH CHANDRA GUPTA, *H. B. Technological Institute*, Kanpur.

Several hundred tons of spent nickel catalyst (nickel mud) is allowed to go waste by the Vanaspati industry every year. As nickel is a costly metal and is imported from abroad, the reactivation of the spent nickel catalyst is of great importance. The paper deals with a practical and economical method for reactivation of the catalyst.

Sampies of spent catalyst from several hydrogenation factories have been analysed and found to contain 42.2% to 84.2% of fat, 7.0% to 11.3% of nickel and 7.0 to 47.4% of siliceous matter with traces of impurities.

Following 3—methods have been tried for recovering adhering fat from spent nickel catalyst.

(1) Extraction with solvent and centrifuging.

(2) Extraction with solvent, settling and filtration.

(3) Digestion by an acid.

Fat recovered by the above first two methods is of much better quality than the fat recovered by the method of digestion with an acid. It is also evident from the paper that the method of digestion with formic acid is the most convenient one for the purpose of reactivation of nickel of the spent nickel catalyst.

The method of acid digestion consists in treating spent nickel catalyst with dilute mineral acid or formic acid and stirring it for a few hours keeping the temperature at 105°c.

The fat is separated and generally floats on the top and the nickel goes into solution in the form of nickel formate.

The impurities of iron and aluminium are removed from the solution of nickel formate by precipitating them as their hydroxides using basic nickel carbonate and hydrogen peroxide.

The nickel formate obtained above compares favourably with the imported one as regards its catalytic activity in the process of hydrogenation.

SECTION E

PHYSIOLOGY AND BIO-CHEMISTRY

1. Studies on Lipid Metabolism : Part II Effect of High Protein Diets on the Development of Experimental Atherosclerosis and the Role Played by Glucose-Cyclo-Acetoacetate
by NATH, M C. *and* SAIKIA, A. *University Department of Bio-chemistry,* Nagpur.

Much work has been done in recent years to claim that dietary and nutritional factors, in some way or the other, influence the development of atherosclerosis and further, it has been claimed that this disease is prevalent among the economically advanced countries of the west. The earlier works held the view that atherosclerosis is the result of intake of high protein food which may influence cholesterol retention and its metabolism.

In the present paper, the male adult albino rats were fed the high protein diets at 40p.c. level (defatted egg albumin and casein and meat) for a period of 15 weeks. Another three sets of animals given the same diets but simultaneously injected with hydrolysed GCA were studied to see the physiological significance of this substance.

From the bio-chemical investigations of the free, total, ester cholesterol, phospholipid of the plasma and tissues, it has been found that hypercholesterolemia has been developed

significantly in the animals fed only high protein diets with the elevated C/P (Total Cholesterol/Lipid Phosphorus) and low F/T (Fre/total cholesterol) ratios, The phospholipid levels in the tissues of these animals have been decreased markedly whereas those treated with hydrolysed GCA in addition to high protein diets have been found to show almost normal lipid levels in the plasma and tissues with low C/P and high F/T ratios. On further investigations, it has been observed that the liver fat and their iodine values of the hypercholestrolemic animals were below normal with low levels of liver methionine content, whereas these levels are found to be comparatively far higher in case of the animals treated with GCA (hydrolysed).

It has been shown that prolonged feeding of high protein diets at 40p.c. level caused the gradual development of hypercholesterolemia and atherosclerosis in the animals which may be due to the fact that high protein intake might have influenced food cholesterol retention and its metabolism. This gradual development of hypercholesterolemia has been checked significantly by the treatment of hydrolysed GCA. It has been shown, how lowering of the C/P ratio is brought about by GCA by increasing the levels of methionine in the tissues which may bring about greater formation of phospholipids.

2. **Physiological Significance of Inositol, Vitamin B_{12} and Glucose-Cyclo-Acetoacetuate in Cholesterol Induced Atherosclerosis on Rabbits** *by* NATH, M. C. *and* SAIKIA, A. *University Department of Biochemistry*, Nagpur.

It has been shown by a number of investigators that a diet high in cholesterol is responsible for the onset of the development of atherosclerosis. Further, investigations have been made to show that the lesions caused in the aorta of rabbits induced atherosclerosis experimentally and those observed in the coronary arteries of atherosclerotic human patients on autopsy were similar. Atherosclerosis has always been found to be associated with hypercholesterolemia.

In the present paper, male rabbits were made hyperlipemic by supplementation of 0. 5 g. cholesterol in olive oil in their diet for a period of 10 weeks. During the experimental period five out of six groups of animals were treated with inositol (.5 g.) vitamin B_{12} (Macrabin 10 ug.), glucose-cyclo-acetoacetate (GCA) (300 mg./kg,), hydrolysed GCA (300 mg./kg.) fed and injected respectively and physiological significance of these substances has been studied.

The animals were sacrificed for the biochemical investigations of free, total, ester cholesterol and phospholipid of serum, liver and kidney. The hypercholesterolemia with elevated C.P (Total cholesterol/lipid phsphorus) and low F/T (Free-Total cholesterol) ratios have been observed in the control group (i. e only supplemented with cholesterol in the diet). These indicated that the animals were in the hyperlipemic state associated with athrosclerosis. Inositol, vitamin B_{12} and GCA hydrolysed or unhydrolysed, have been found to check the increased levels of free, total, ester cholesterol and C/P ratios both in the serum and the tissues to a great extent. Vitamin B_{12} and GCA (hydrolysed) when injected have lowered the serum C/P ratios almost to normal levels. More pronounced effect of maintaining normal levels of free, total, ester cholester, C/P and F/T ratios in the serum and tissues have been recorded on treatment with hydrolysed GCA (injected or fed). On further investigation, it has been found that the total methionine contents of the livers of the animals of the groups treated with inositol or GCA (hydrolysed or unhydrolysed) are in the increased levels as noticed in vitamin B_{12} treated animals. The gain in body weight of animals was more or less similar, It was noted that the hydrolysed GCA caused the increased levels of methionine and gain in body weight of animals even to a much greater extent than those of the animals treated with vitamin B_{12}. On supplementation of cholesterol, the liver fat and their Iodine Values of the animals have been significantly reduced whereas these levels were comparatively higher in the case of the animals treated with inositol vitamin B_{12} and GCA (hydrolysed) or GCA alone.

3. Studies on the bio-isomerisation of ingested fats *by* B. T. R. IYENGAR *and* M. M. CHAKRABARTY, *Dept. of Applied Chemistry, College of Science and Technology*, Calcutta.

Although many studies have been made on the subject of preformed fats by animals yet little or no work appears to have been made on the bio-isomerisation of fats. The presence of considerable amounts of conjugated triene acids (α-elaeostearic acid) in some common Indian vegetables, like *parwal* (Tricosan thes dioica), Karela (Momordica charantia), and snakw gourd (Tricosanthes anguina) provided an opportunity to study this aspect of lipid deposition. The easy detectability of α-elaeostearic acid by spectrophotometric procedures renders them almost equal to the position of labelled substances. Two sets of animal experiments with rats were undertaken, each being divided into two groups, control and experimental. In one set the rats were maintained on a diet of 10% fat level (supplemented with all other accessory food factors) with refined M. charantia (Karela) seed fat containing 43% α-Elaeostearic acid. In another set, refined G. N. O. was used for the control. The experiments were conducted for a period of 2 and 5 weeks respectively. Analysis of the results show lower growth promotion and food efficiency for the experimental group fed with Karela seed oil. There was very little deposition of conjugated acid and the body fats of the experimental groups showed an appreciably higher percentage of linolenic acid. The linolenic acid level corresponded more or less with the amount of this acid present in the dietary fat.

4. Studies on the Processing, Storage and Nutritive value of Cottonseed oil *by* V. SUBRAHMANYAN, M. NARYANA RAO, K. KRISHNAMURTHY, S. KUPPUSWAMY, M. SWAMINATHAN *and* D. S. BHATIA, *Central Food Technological Research Institute*, Mysore.

The proportion of linters and kernel in nine Indian varieties of cottonseed were found to be slightly lower than those reported for American varieties. The oil content of whole seeds and kernels ranged from 14 to 19·4% and 29 to

35% respectively, which are slightly lower than those reported for American varieties.

Alkali refining of crude cottonseed oil yielded an oil with a light colour (Red 1.0, yellow 19.9). Rerefining of the oil improved the colour to an appreciable extent. Fuller's earth alone had some bleaching effect, but when used along with animal charcoal or saw dust charcoal, it served as a good bleaching agent.

The gossypol content of crude cottonseed ranged from 0·38 to 0·47 percent and was similar to that of Egyptian and Sea Island oils. Refinining of cottonseed oil removed the gossypol completely.

Crude cottonseed oil is very stable even when stored in metal vessels and this may be due to the presence of gossypol having antioxidant activity and phosphatides possessing metal deactivation property. Refined cottonseed oil developed peroxides more rapidly than refined groundnut oil.

No significiant difference between the growth promoting value of crude, refined and hydrogenated cottonseed oil, refined groundnut oil and cow's ghee was observed. There was no significant difference in the digestibility of crude, refined and hydrogenated cottonseed oils in studies on albino rats. The retention of calcium and phosphorus in rats fed on diets containing 10% of crude, refined and hydrogenated cottonseed oil was almost similar to that observed with groundnut oil and cow ghee.

5. **The Chemical Composition Keeping Quality and Nutritive Value of Safflower and Nigerseed oils** *by* M. NARYANA RAO, M. SWAMINATHAN *and* V. SUBRAHMANYAN, *Central Food Technological Research Institute,* Mysore.

Safflower and niger seed oils are used to a considerable extent for edible purposes in Bombay and Mysore States. Very little information is available on the keeping quality and nutritive value of the oils. Analysis of the oils showed that both the oils contain a large amount of oleic and linoleic acid glycerides. The stability of crude, refined and bleached

safflowed seed oil and niger seed oil was studied by the A. O. M. test as well as by storing in aluminium and tin containers for a period of three months and following the rate of development of peroxides. The results indicated that both safflower and niger seed oils are easily susceptible to oxidative rancidity and are not as stable as groundnut oil.

Rat growth studies have shown that both safflower and niger seed oils promote good growth comparable to that of groundnut oil and cow ghee. Studies on the *in vivo* digestibility of safflower and niger seed oils on albino rats have shown the average digestibility coefficients were 98·6 and 95 6 per cent respectively. The inclusion of safflower and niger seed oils at 10% level in an adequate diet caused an increase in the utilization of both calcium and phosphorus as compared with a fat free diet. In this respect both safflower and niger-seed oils were slightly superior to groundnut oil or cow ghee.

6. **Effect of Heat on the Nutritive Value of Edible Vegetable oils** *by* N. V. RAJU, *Central Food Technological Research Institute*, Mysore.

Very little scientific information is available regarding the adverse effects, if any, of consuming articles of foodstuffs fried in oil. Oils are heated in open iron pans and as such the changes which the oil undergo are highly varying. Further, the residual oil from a day's operation is added to fresh oil and used for frying on a subsequent day. This may accelerate the oxidative and other changes.

It was therefore felt desirable to collect some data on this important problem. It was found that when young albino rats were fed, diets containing 15% of the heated oil, there was growth depression to the extent of 50% as compared with control rats receiving unheated oil, and the liver fat was increased by 100%. Nearly all the edible oils gave the same type of results.

The absorption, utilisation and storage of vitamin A and carotene were considerably reduced when fed through the medium of the heated oils. The stability of vitamin A kept

stored with diets containing the heated oil was very poor. Other B-complex vitamins were destroyed to varying extents.

Experimental evidence on the above and other aspects of study will be presented and discussed.

7. Effect of Dietary Fats and Cholesterol on the Serum Poly-unsaturated Fatty Acids in Rats *by* V. S. PATIL *and* N G. MAGAR, *Department of Biochemistry, Institute of Science*, Bombay.

Young rats on fat-free diets were fed with (a) coconut oil, (b) hydrogenated groundnut oil, (c) butter fat (ghee), (d) groundnut oil, at 20 per cent fat level. 0.50 g. of cholesterol per kilogram weight of the rat was included in all the diets, for about thirty four weeks. Influence of dietary fats showed that the increase in the body weight of the rats was proportional to the polyenoic fatty acids present in the diet. Average final weights of rats fed with dietary fats with cholesterol seemed to be higher than those of without cholesterol. Total fatty acids per 100 c.c. of serum were higher in the groups of rats fed with cholesterol. The level of dienoic acids and tetraenoic acids were lowered gradually with the influence of feeding cholesterol. Hexaenoic and pentaenoic acids were present in traces. The small amounts of trienoic acids were constant except in groups fed coconut oil. In the latter case there was an increase of trienoic acids.

8. The Nutritive Value of Cooked, Uncooked, Raw and Refined Vegetable Oils *by* G. C. ESH, M. L. SEN GUPTA *and* S. BHATTACHARYA, *Bengal Immunity Research Institute*, Calcutta.

Heating (in open air) tends to alter significantly some physical and chemical characteristics of the oils including hydrogenated oils, such as iodine value, acid value, peroxide value and viscosity depending upon the period of heating and nature of oils. Heated oils when fed to weanling rats depress the growth rate. The influence of feeding heated oils

on the liver fat, degree of unsaturation in the blood lipid, any alteration in the kidney and other body organs are also being studied and compared to those of normal rats.

9. Vitaminised Oil Rich in Essential Fatty Acids *by* G. C. Esh *Bengal Immunity Research Institute*, Calcutta.

Cod liver oil was being largely used in medicine for its vitamin contents as well as for the characteristic unsaturated fatty acids it contains. This is now being largely replaced by shark liver oil which is not so rich in unsaturated fatty acid. Work has accordingly been undertaken to enrich the latter by incorporating vegetable oils rich in unsaturated fatty acids as Safflower oil and subsequently to study the keeping properties and nutritional efficacy such of preparations.

10. The effect of different food fats on experimental atherosclerosis and the beneficial role played by essential fatty acids, vitamin B and glucose-cyclo-acetoacetate *by* M. C. Nath & A. Saikia. *University Department of Biochemistry*, Nagpur.

The effect of feeding rabbits with different types of fats viz. hydrogenated vegetable fat viz. Dalda (I. V. 68) and linseed oil (I. V. 160) at 15 p.c. level in the diet for a period of 12 weeks on free and total ester cholesterol and phospholipid levels of serum and tissues have been studied and liver fats, their iodine values, total fecal fat and growth of the animals have been recorded. Higher levels of serum and tissue cholesterol with elevated C/P (Total Cholesterol/Lipid Phosphorus) and reduced F/T (Free/Total Cholesterol) ratios have been observed in case of animals fed dalda. Significantly lower cholesterol levels and lower C/P and higher F/T ratios were noticed when dalda diet was supplemented with linseed oil at 5 p.c. level. Supplementation with an essential fatty acid mixture containing linoleic and linolenic acid (1 : 3) of I. V. 245 to the dalda diet has been found to cause much reduction in the serum and tissue clolesterol values, thus resulting into lower C/P and higher F/T ratios as compared

to those of the animals kept on dalda as source of fat alone. On injection of hydrolysed glucose-cyclo-acetoacetate (GCA) to one of the groups fed dalda, the serum and tissue cholesterol levels and C/P ratios were also found to be much lower than those observed in animals fed dalda, or even the mixed diet containing dalda and linseed oil. Almost normal lipid levels in serum and tissues with the normal limit of C/P and F/T ratios have been obtained on injection of vitamin B_{12} to the animals fed dalda along with essential fatty acids. But much more pronounced effect was noted when the animals kept on dalda and essential fatty acid were also treated with GCA. These values were found to be more or less similar to those noticed in the group of animals kept on linseed oil only as the source of fats and oils.

The maximum gain in body weight has been found with the animals fed unsaturated oil accompanied with higher level of fecal fat.

Increased level of liver fat with low I. V. has been recorded in dalda fed animals. It is true that the cholesterol and phospholipid levels of the serum and tissues have been found to be proportional to the degree of unsaturation of the fat in the diet ; but the animals receiving dalda, essential fatty acids and GCA, where unsaturation was not to the same extent as in linseed oil diet alone, have however, shown better results.

11. Utilization of oilseed cake *by* C. R. KRISHNA MURTI & C. SINGH, *Central Drug Research Institute*, Lucknow.

In an attempt to prepare a protein hydrolysate of vegetable origin, oil seed cakes, particularly those of Til and Mustard have been utilized for this purpose, These were chosen because of their easy availability in this part of the country and methionine content. Chemical and microbiological assays have shown that all the essential amino acids are present in the protein hydrolysate from the oil seed cakes. Incorporating it as a sole source of nitrogen into an otherwise complete synthetic diet in nutritional experiments on albino rats, it has been shown that it is acceptable and growth response is as good as that with casein. The preparation has

its potentialities as a dietary supplement and in oral therapy in conditions of severe protein deficiencies during convalescence, undernutrition and malnutrition, specially for vegetarians.

SECTION F

CHEMISTRY OF FATS AND OILS.

1. Heavy Metal Soaps As Initiators of Vinyl Polymerization *by* V. LINGAMURTY AND SANTI R. PALIT, *Indian Assosiation for the Cultivation of Science*, Calcutta.

Metallic soaps are known to be powerful accelerators for the polymerisation of drying oils, though the mechanism is still somewhat obscure. The present investigation of the application of these heavy metal soaps to the polymerisation of vinyl monomers has been undertaken by the present authors with a view that it may throw some light on the various aspects of its application to drying oils. The polymerisation of methyl methacrylate using ferric laurate as catalyst has been extensively studied and the results obtained thereof are presented herewith. The rate of polymerisation increases rapidly with increasing catalyst concentration, attains a maximum value and slowly falls down to a very low value at high concentration of the ferric soap. The fatty acids like oleic and lauric acid have practically no effect on the polymerisation of methyl methacrylate. Also soap catalysed polymerisation of methyl methacrylate is susceptible to inhibition by hydroquinone and fails to give any test for the reduction of ferricion to the ferrous stage. The degree of polymerisation seems to be abnormally high. Oxygen seems to be a co-catalyst at low concentration of the soap. All the above mentioned unusual features distinguish this catalyst from the hitherto known types of catalysts used in vinyl polymerisation.

2. **Isomerisation and Solvent Fractionation of Safflower Oil** *by* K. K. DOLE *and* Y. K. PURANDARE, *Fergusson College* Poona.

Safflower oil is a good drying oil (I. V.=145·0) and contains 64·6p.c. linoleic acid as its main constituent. It was isomerised by using different catalysts under different conditions.

Of the various catalysts used, free iodine, iodic acid, hydriodic acid, nickel-carbon and sodium hydroxide were found to bring about a substantial isomerisation in safflower oil.

The various isomerised oil samples were tested for dry ng time and other film properties like resistance towards water, solvent and alkali and it was found that the samples showed betterment in these properties. Synthetic varnishes of these isomerised oil samples are being prepared and their properties are being studied.

3. **Compositions of oils by urea fractionation method,** *by* T. N. MEHTA *and* S. B. DABHADE, *Laxminarayan Institute of Technology*, Nagpur.

In search of methods for resolution of fatty components, urea fractionation procedure is found to be simple, widely applicable and a reliable one. This can directly replace the usual lengthy procedure of ester fractionation involving hydrolysis of esters, lead or lithium salt separation, re-esterification and finally distillation.

The urea fractionation procedure is easy for manipulation, and can be worked at room or lower temperatures. It needs simple apparatus and affords separation of the homologous series as in the ester distillation, as well as separation according to the degree of unsaturation as in the lead-salt-alcohol, lithium-salt-acetone or low temperature crystallization procedures.

The adoption of urea-complex formation for resolution of fatty components has been attempted with different methods arrived at in our laboratory. The compositions arrived at by the urea methods compared fairly well with those obtained by

altogether different methods. For illustration, mixed fatty acids of sesame and safflower oil and their methyl esters have been fractionated by eluting urea adduct of total acids by alcohol. It is found that the separation in this procedure is similar to that of classical and displacement chromatography with urea as an adsorbent.

Fractionation data have been obtained by varying the amounts of urea and keeping the concentration of mixed fatty acids in methanol the same. The data obtained can be utilized for determining the rough composition of the mixed fatty acids as well as for fractionating mixed fatty acids into desired fractions.

The advantages of urea procedure have been discussed in light of other fractionation procedures.

4. **Mode of fractionation of Chaulmoogra oil fatty acids with urea.** *by* T. N. MEHTA *and* S. B. DABHADE, *Laxminarayan Institute of Technology*, Nagpur.

The fatty acids of chaulmoogra oil were fractionated with urea to study the mode of separation. Aliphatic acids separate first and are followed by chaulmoogric, hydrocarpic, alepric, of aleprylic, and gorlic acids. The lower homologues of hydrocarpic acid and gorlic acid do not form stable adduct with urea at room temperature (30°C).

5. **Bodying of Linseed oil** *by* R. S. KONAR *and* A. N. SAHA, *University College of Science and Technology*, Calcutta.

Linseed oil has been bodied by passing the oil through a molten eutectic salt mixture consisting of 53% KNO_3, 7% $NaNO_3$, 40% $NaNO_2$. The oxidised and polymerised portion insoluble in acetone can be separated by centrifugation. Salt mixture under the conditions of experiment looses certain amount of its oxygen.

6. The Glyceride Structure of Swine Depot Fat *by* H. G. RAMAKRISHNA REDDY, *Government Soap Factory*, Bangalore.

The depot fat of a male pig reared on a low-fat diet was examined for its fatty acid composition and glyceride structure. The types of glycerides found by the disruptive oxidation and the low-temperature crystallization methods are not in conformity with any of the known hypotheses.

By subjecting the depot fat and the major fractions of GS2U and GSU2 obtained by low temperature fractionation to enzymatic hydrolysis, it is found that the unsaturated fatty acids are predominantly linked to 1 and 3 positions ; while the saturated acids and the minor amounts of polyethenoid acids are linked to the position in the glyceride molecules.

The glyceride structure of the swine depot fat is decidedly non-random and the experimental evidence seems to indicate the operation of a selective affinity of specific fatty acids to the two chemically distinguishable positions of the glycerol molecule in the biosynthesis of natural glycerides.

7. Correlation of physico-chemical constants of Indian Vegetable oils *by* T. V. SUBBA RAO, *Research Laboratory, Tata Oil Mills Co. Ltd, Sewri*, Bombay.

The scientific approach for adjudging the purity of vegetable oils and fats would be by adopting an approved scientific method of sampling from the bulk lot and comparing the observed physico-chemical constants with the natural limits for these characteristics. The available published information on the physico chemical constants of the major Indian Oils is subjected to statistical study and the natural limits therefrom are compared to the Indian Standard Specifications for the respective oils. Some of the results obtained in this study were published earlier. In this paper, the results obtained in further study are presented.

The physico-chemical constants of oils are to some extent interrelated and a knowledge of the correlation factors would serve as a helpful guide in adjudging the purity of oils. The

correlation factors have been worked out for some of the Indian vegetable oils.

8. Conjugation Changes in Groundnut Oil *by* M. L. SEN GUPTA *Bengal Immunity Research Institute*, Calcutta.

Under a variety of conditions, groundnut oil may give rise to conjugated products. Alkali isomerisation leading to the formation of diene conjugated linoleate is now used as a common analytical technique. When autoxidised, the oil develops peroxides, a part of which is diene conjugated. When such an oil containing peroxides is treated with acidic bleaching clays, the oil develops triene conjugation, the peroxides being eliminated in the process ; treatment with reducing agents like potassium iodide and acetic acid also results in the formation of conjugated triene. Oils containing conjugated triene as a consequence of bleaching, when subjected to autoxidation, again exhibit characteristic conjugation changes ; as the peroxide value rises, the conjugated triene gradually disappears, ultimately vanishing completely at rather low peroxide level, and the conjugated diene goes on increasing until peroxides begin to decompose.

9. Studies on Vitamin A in Solution, Part VIII *by* SUKHAMOY BHATTACHARYA, *Bengal Immunity Research Institute*, Calcutta.

Vitamin A is now available in the form of pure acetate or palmitate, and, is being largely used for pharmaceutical purposes either in a dispersed form, or, in solution in oil or in ethyl esters of fatty acids. In such preparation presence of essential unsaturated fatty acid like linoleic acid is preferred. Accordingly an investigation is in progress to find out how vitamin A behaves when dissolved in Safflwer oil which is rich in linoleic acid. This oil, however, is susceptible to rancidity and as such an investigation is being followed to study the keeping properties of vitamin A when dissolved in this nutritive solvent.

SECTION G

1. Role of standardization in the field of vegetable oil industry *by* P. S. NARAYANA SWAMI, *Indian Standards Institution*, New Delhi.

India is the fifth largest producer of oil seeds, and vegetable oil industry is one of her major national industries. To meet the ever increasing internal demands of oils, both for human consumption and industrial purposes, and also to compete in the World markets, all the national resources are required to be pooled systematically in order to upgrade both the production and quality. Standards facilitate flow of products and interplay of information resulting in technological advancement. Standardization reduces unnecessary variety and also helps consumer by assuring him minimum quality as well as the manufacturer by providing him standard quality raw-materials. It promotes export trade.

The Indian Standards Institution, established since January 1947, has published a series of more than 1000 standards covering various subjects which includes oils, soaps, bleaching earths and paint and allied products. A number of other subjects of economic importance to vegetable oil industry are in the initial stages of the process of standardization. The rate of progress and achievements can go faster with increased collaboration and participation by the industry which paves way to an all round growth.

2. A new method of estimation of unsaturated glyceride *by* G. C. DEY, D. MUNSHI, D. MUKHERJEE *and* A. N. SAHA, *University College of Science and Technology*, Calcutta.

A new method has been evolved on the basis of the solubility of the lead salts of maleic anhydride adducts of glycerides of unsaturated conjugated acids. The Pb salts of different glyceride adducts precipitate from alcoholic solution of the salts at different temperatures.

3. **Chromatographic Separation of glycerides and unsaturated fatty acids,** *by* B. T. R. IYENGAR *and* M. M. CHABKRABARTY, *University College of Science and Technology*, Calcutta.

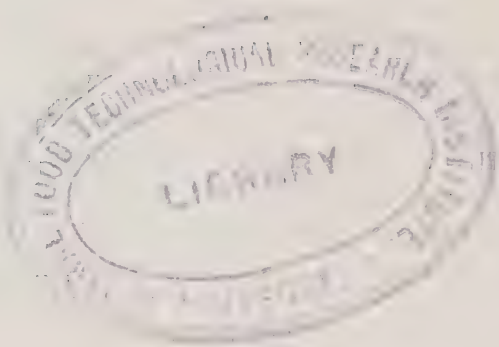
Chromatography which is one of the most effective techniques in the separation and quantitative analysis of a wide variety of substances is being used more and more in almost all its aspects in the lipid field, not only as a research but also as a routine tool. Considerable work has been done in the separation of saturated and non-conjugated unsaturated fatty acids but very little in the separation of conjugated acids. Regarding glycerides some investigations in the separability of both natural and model mixtures of glycerides have been carried out, before the advent of modern methods of analysis. In the present work chromatographic separation of various conjugated and non-conjugated fatty acids and glycerides have been studied in conjunction with modern techniques like spectrophotometry. Poppy seed oil was used and a spread of iodine value from 116-169 has been observed indicating the presence of trilinolein. Behaviour of tung oil as such and as methyl esters of the mixed fatty acids have been observed. It was found that trielaeostearin was present to a considerable extent and could be isolated, and in the case of the fatty acid itself almost pure elaeostearic acid could be obtained under ideal and optimum conditions of experimentation.

SECTION H

1. **Plant and equipment for oil extraction industry** *by* Y. K. RAGHUNATHA RAO, *Central Food Technological Research Institute*, Mysore.

Solvent extraction of vegetable oils is the immediate field for technological expansion. Rapid progress in oil production is possible only by availability of the required plant and equipment. Design and construction of extraction plants have been under study in a chemical engineering research laboratory.

Pilot Plants have been designed, fabricated and operated for several years. A commerical plant will be made this year in Indian workshops, according to the new process developed in India. Favourable conditions for the growth of plant construction industry exist in India. Manufacture of the machinery, will stabilise the vegetable oil industry and encourage export of products and improve economic conditions in the country.



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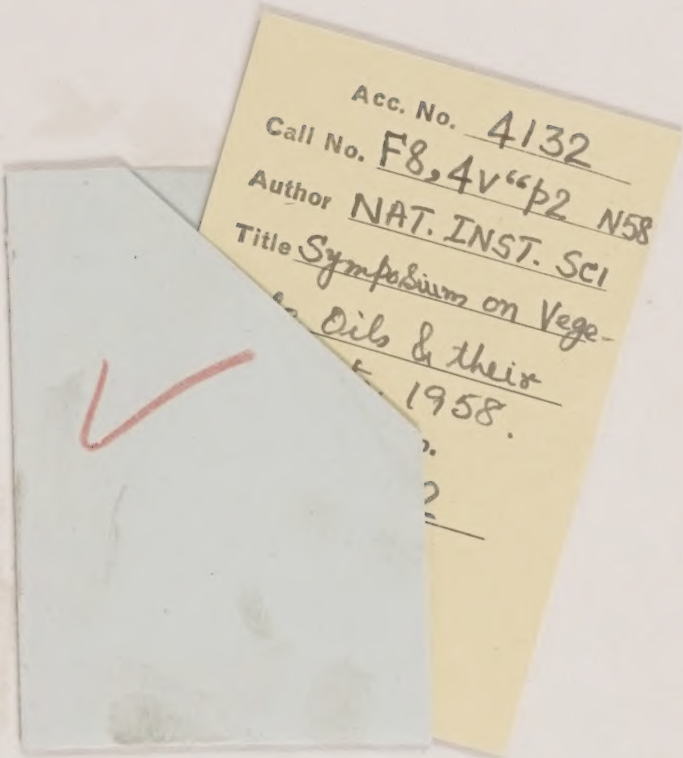
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